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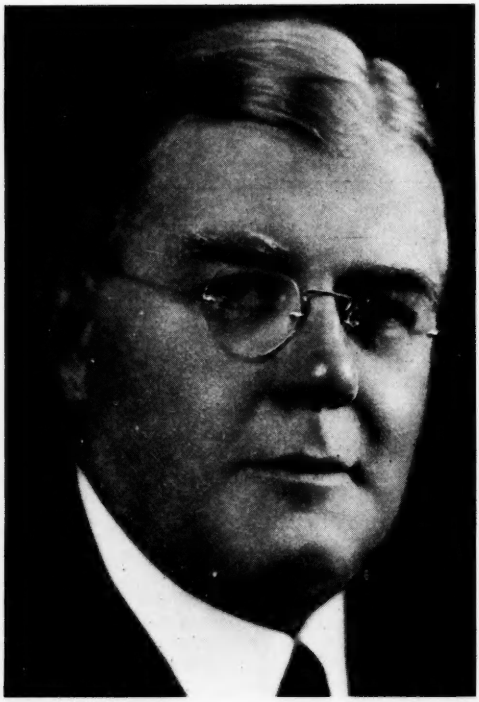

Photo by Bachrach

DR. ELVIN H. KILLHEFFER,

President of United States Institute for Textile Research, Inc.

Adjourned Annual Meeting, and Luncheon in Honor of English Guests

THE annual meeting of U. S. Institute for Textile Research, adjourned from Nov. 12, 1937, was held at the Hotel Pennsylvania, New York, N. Y., Tuesday, May 24, at 11 A. M. Acting-President, Dr. E. H. Killheffer, spoke briefly of the reasons for the adjournment, and the principal business was the election of directors for a term to expire in 1940, and action upon a report of the Committee on Revision of the By-laws. The amendments recommended by that committee were adopted and are presented and described elsewhere in this issue.

Directors elected were as follows: John Bancroft, Jr., president, John Bancroft & Sons Co., Wilmington, Del.; Earl Constantine, secretary, National Association of Hosiery Manufacturers, New York, N. Y.; Philip A. Johnson, Jewett City, Conn.; D. H. Powers, Röhm & Haas Co., Philadelphia, Pa.; Robert E. Rose, E. I. du Pont de Nemours & Co., Wilmington, Del.; Harold DeW. Smith, treasurer, A. M. Tenney Associates, New York, N. Y.; P. J. Wood, Paterson, N. J.; Douglas G. Woolf, editor, *Textile World*, New York, N. Y.

In addition Arthur Besse, president, National Association of Wool Manufacturers, New York, N. Y., was elected a director for a term expiring in 1939, succeeding G. E. Hopkins, resigned.

English Guests Honored

Following the adjourned annual meeting a luncheon was tendered by the Institute in honor of Frank Nasmith, president, and J. R. S. Goodall, chairman Diplomas Committee, The Textile Institute, Manchester, Eng., at which function we also had as our guests the heads of many of the other leading textile associations. Messrs. Nasmith and Goodall were visiting this country partially on private business, but mainly for the purpose of contacting American members of The Textile Institute

and the officials of various textile associations whose activities are similar, in part at least, to those of the British organization. Their itinerary had been arranged by a committee of United States members of The Textile Institute headed by Dr. H. DeWitt Smith, and this luncheon was the third of a list of meetings and visits covering some ten days. One of the reasons for the delayed date of the Institute's adjourned annual meeting was to make it and the luncheon fit the itinerary of the English guests. The luncheon and other Institute meetings were held in the rooms of the Carlton City Club at the Hotel Pennsylvania.

Officers and Standing Committees Elected

Following the luncheon a meeting of the Board of Directors was held for the election of officers and standing committees for the current year. Acting-President Killheffer presided, and Chairman W. E. Emley of the Nominating Committee reported the following ticket which was adopted unanimously by authorizing the Secretary to cast one ballot for it:

President.—Dr. Elvin H. Killheffer.

Vice-Presidents.—Prof. Louis A. Olney, Prof. Edward R. Schwarz.

Treasurer.—Ernest N. Hood.

Secretary.—Charles H. Clark.

Chairman, Research Council.—Warren E. Emley.

Executive Committee.—John Bancroft, Jr., Alban Eavenson, Ernest N. Hood, Philip A. Johnson, Robert E. Rose, Edward R. Schwarz, Harold DeW. Smith, the President, *ex-officio*, Chairman Research Council, *ex-officio*.

Conference of Drying Research Co-operators

Many of the members and guests who attended the luncheon lingered for some time after its adjournment for social intercourse and discussion of matters of mutual interest. Meantime some 30 representatives of co-operators in the Institute's textile drying research met privately in an adjoining room to hear and discuss an illustrated report of progress by Dr. J. G. Wiegerink, research associate for the project at the National Bureau of Standards. Chairman W. E. Emley of the Research Council presided. One of the reported results of the confer-

ence was the unanimous election by the co-operators of Dr. A. C. Walker, of Bell Telephone Laboratories, New York, N. Y., to succeed G. E. Hopkins, resigned, as chairman of the Administration Committee for the research. Dr. F. Bonnet, American Viscose Co., is the other member of this committee, and he and Dr. Walker have served since the inception of the work.

Minutes of Adjourned Annual Meeting

The adjourned annual meeting of U. S. Institute for Textile Research, Inc., was called to order by Acting President, Dr. E. H. Killheffer, at 11:20 A. M., the Secretary reporting that, in accordance with Article X of the By-laws, copies of the proposed amendments to the By-laws recommended by the committee on their revision had been mailed to all members 30 days in advance of the date of this meeting, and that there was present in person more than the necessary number required for action upon their revision. The agenda for the meeting was as follows:

1.—Report of Acting-President, Dr. Killheffer.
2.—Report of Committee on Revision of By-laws.
3.—Action on report of Committee on Revision of By-laws.
4.—Report of Nominating Committee.
5.—Election of Directors.*
6.—New Business.

In his opening address Dr. Killheffer reviewed briefly the reasons why the annual meeting had been adjourned without action upon the election of directors and officers, and why he had appointed a committee on revision of the by-laws. The plan for a graduate institute of textile research, which he had outlined in his address at the annual dinner, and which the corporation had authorized him to present in detail to the directors of The Textile Foundation, would have required changes in the set-up of the Institute if it had been adopted. The plan was presented to the Foundation directors because they have custody of certain funds which they utilize for the promotion of textile research. The plan contemplated that The Textile Foundation might allocate certain of its funds, provided that the Institute would raise an equal amount of money. In deference to the Foundation there has been no publication in detail of what that plan was or what the amounts called for were. Foundation directors received the plan, considered it, and have decided that they wish to apply their funds in a different manner than had been proposed. "That, therefore," said Dr. Killheffer, "for the moment closes that particular avenue of approach toward the creation of a centrally located textile institute. Since then your Executive Committee has devoted several meetings to consideration of methods by which the existing organization may operate more efficiently, and the committee on revision of the by-laws has worked along similar lines. It is believed that such progress as the Institute has made since its organization has been in a forward direction, although disproportionate to the time and energy that has been

* Directors whose terms had expired or who had resigned were as follows: Expired.—John Bancroft, Jr., J. E. Edgerton, Philip A. Johnson, Charles B. Nichols, Robert E. Rose, H. V. R. Scheel, Harold DeW. Smith, P. J. Wood. Resigned.—G. E. Hopkins.

devoted to it by your directors and most active members. Perhaps one of our most noteworthy and encouraging accomplishments has been in organizing and securing the financial support of research projects by the industry. One of these researches is financed on a 50-50 basis by the Textile Foundation and textile firms, and another is wholly financed by the industry. This is something that was never done before, and is a step in the right direction. The financial support for these projects, however, comes from less than 100 manufacturers and allied firms. It justifies us to continue to carry on only because it holds some promise of eventual success."

Acting-President Killheffer then called for the report of the Committee on Revision of By-laws. Chairman Eavenson of that committee stated that the proposed amendments had been transmitted to the Secretary and by the latter to the membership 30 days in advance of this meeting, as provided by the by-laws. Instead of explaining in detail why the changes had been proposed, he suggested, since members had been given ample time to study the amendments, that they give the committee the benefit of their opinions, explain objections if any, or query the committee as to the reasons for changes that are not understood.

The discussion that followed was mainly confined to the revised basis of Contributing Membership dues and privileges. Several members who have been responsible for interesting the heads of their companies in such memberships felt that it would be difficult to convince them that payment of an additional $50 to have the privilege of subscribing for the progress reports of a co-operatively financed research would be worth while, particularly as the accompanying free subscriptions to the Institute magazine were reduced from five to one. As one member put it: "Textile executives are hard-boiled, rugged individualists who demand *quid pro quo*, and are not particularly research-minded."

It was explained by members of the committee that before the Institute had any co-operatively financed researches it had some 35 Contributing members paying $100 each wholly for the good of the cause. When the co-operative financing of researches was started these members had the privilege of receiving the progress reports of any one research, and new subscribers to such researches at $100 were given Contributing Memberships at no extra cost. Furthermore, when the drying research was co-operatively financed by 50 subscribers it was provided that every dollar of the $5,000 subscribed should be segregated for the expenses of that project; all costs of its promotion to be charged to general expenses of the Institute. The Institute's general expenses have averaged about $6,000 a year, and with practically all Contributing Membership dues applied to actual research expenses, as is the trend, only annual membership dues, which have been averaging around $2,000 a year, would be available for general expenses. Unless sufficient Contributing Membership dues at $50 a year are made available for general expenses, the only alternative would be a percentage charge against research subscriptions. The latter has been the policy of some organizations engaged in research, but for the Institute would be particularly undesirable in view of the revised policy of the Textile Foundation in connection with research grants.

It was explained by Chairman Eavenson "that the members of this committee on revision of the by-laws all happen to have been selected as members of the special advisory committee recently appointed by the Textile Foundation. There is no doubt that our work on the former

committee was influenced by our desire to place the affairs of U. S. Institute in shape to handle what the future seems to hold. The Textile Foundation has been avoiding publicity just as much as possible. In the report which the advisory group made to the Foundation we advocated that it should no longer continue the policy of hiding its light under a bushel, and that it should start an active campaign of research publicity. We also recommended that its research work, which is to be centralized largely at the National Bureau of Standards, with some outside work, shall be devoted to fundamental research, and if and when fundamental data are secured, then through proper publicity, which is to be supported by the Textile Foundation, practical mill study should be encouraged and be financed by the mills themselves. That is where U. S. Institute comes in, and it was our thought that anyone interested in the success of this program would be very glad to contribute $50 to make it possible for the Institute to engage in the promotion of this mill research. In other words we are putting ourselves in shape to take advantage of an opportunity which the future seems to hold."

There being no further discussion and the question being called for, it was duly moved, seconded and unanimously

> *Voted:* That the amendments of the by-laws as reported by the Committee on Revision of the By-laws be adopted to become effective Oct. 1, 1938.

Chairman Emley of the Committee on Nominations (W. E. Emley, Chairman, Alban Eavenson, Dr. H. DeW. Smith) submitted the following ticket for directors whose term will expire in 1940: John Bancroft, Jr., Earl Constantine, Philip A. Johnson, D. H. Powers, Robert E. Rose, Harold DeW. Smith, P. J. Wood, Douglas G. Woolf. For a term expiring in 1939, Arthur Besse.

No other nominations having been made it was moved, seconded and unanimously

> *Voted:* That the Secretary be instructed to cast one ballot for the list of directors submitted by the nominating committee.

Under the head of New Business there were various suggestions as to methods of increasing membership, as to the desirability of holding more frequent meetings or conferences to stimulate member interest, and as to the possibility of organizing sections and the holding of sectional meetings. Acting-President Killheffer expressed the hope that every member would act as a committee of one on membership, and promised that the various suggestions for improvement of the Institute's work would be given serious consideration by the Board and Executive Committee.

There being no other business the meeting adjourned at 12:30 P. M.

Amendments to By-laws Adopted

WITH one relatively minor exception there has been no revision of the by-laws of the Institute since their adoption Nov. 6, 1930. The exception was adopted Feb. 24, 1931, and defined the Executive Committee and the Board of Trustees "as standing or permanent committees." It merely corrected an oversight in the original by-laws.

During recent years it has become apparent that certain parts of the by-laws had become obsolete, and that others required amendment to pro

vide official recognition of changes in set-up of the organization that experience had proved desirable. At the last annual meeting, therefore, the following committee on revision of the by-laws was appointed, and their report acted upon at this meeting is the result of protracted and careful study, not only of the results of past experience but of probable future needs: Alban Eavenson, Chairman; W. E. Emley, Dr. Robert E. Rose, Dr. H. DeW. Smith.

As an example of obsolescence of some sections of the old by-laws may be mentioned the three classes of membership defied as "Founder," "Benefactor" and "Sustaining," paying fees respectively of not less than $10,000, $5,000, and $2,500. Business conditions since the organization of the Institute in 1930 have not stimulated demand for these types of membership, and no effort has been made to stimulate it. The amended by-laws, however, which provide a Life Membership fee "of not less than $1,000," retain in effect the privilege of donating any larger sum.

The elimination of Founder, Benefactor and Sustaining memberships has rendered "null" the reference to them in Article II, Section 5(b) as qualification for election to the Board of Trustees. Although Article II, Section 5(b) thus revised was presented in the Committee's report and was adopted, it is questionable whether that action was necessary.

In the amended articles the Research Council has been accorded the importance and authority which have for some time been vested in it by actions of the Board of Directors. Experience has demonstrated the wisdom of making the Research Council responsible for suggesting, planning, placing and supervising the conduct of researches subject only to authorization by the Directors or Executive Committee. To this end the Research Council is now officially designated as one of the standing or permanent committees, and its Chairman must be a member of the Board and of the Executive Committee.

One of the most radical changes in Institute policy provided by the amended by-laws is found in Section 3 of Article I, and in Article VIII, Section 1. The latter reduces annual dues of Contributing members from $100 to $50, thus encouraging an increase in this class of membership from firms and individuals willing and desiring to aid the Institute in providing adequate scientific and economic research for the industry. Contributing members, and only Contributing members, "shall be entitled to participate in any co-operative research project conducted by the Institute by subscribing, for each such co-operative research project which it desires to support, $100 annually or such other sum or apportionment as may be specified by the Directors. Such subscription will entitle the co-operator to receive reports of each research subscribed to, as rapidly as issued."

Two objectives, that experience in promoting and financing co-operative researches has demonstrated to be vitally important, are the goal of these particular amendments. One is the apportionment of all monies subscribed to a specific research project for the research expenses of that project. The other is to provide more adequate funds for the relatively small general expenses of the Institute, and for the promotion of specific research projects.

Heretofore, subscribers to specific research projects at $100 each have been given Contributing membership (annual dues $100). In the case of the warp sizing research all expenses involved in securing subscriptions,

and in promotional work incident thereto were charged against the fund finally collected. Thus, the Institute's general funds were not reduced thereby. However, when the textile drying project was financed the cost of all promotional and canvassing work was charged against general expenses, and the entire $5,000 raised for the first year was devoted solely to actual research. For many reasons, and particularly because the latter method allows more accurate budgeting of research expenses, the by-law revisions noted have been proposed and adopted. It is now up to the industry to co-operate and take out sufficient Contributing memberships at $50 a year to qualify for participation in co-operative research projects, and to provide adequate funds for the Institute's promotional work and general expenses.

Article I, Section 1 of the old by-laws restricted membership to citizens of this country and to companies incorporated under its State laws. The amendment of this section opens membership "to individuals and organizations who are interested in textile research," without restriction. This is in line with the policy of most other bodies engaged in scientific or economic research of a basic nature. That policy encourages, and usually results in, free interchange of new fundamental results of research.

The amendments to the by-laws, and a record of the articles and sections that are unchanged, are as follows:

Article I

Section 1. Membership. Membership in this corporation shall be open to individuals and organizations who are interested in textile research. Members other than individuals shall appoint an individual representative.

Section 2. Classification of Members. The membership of this corporation shall consist of three classes dependent upon the payment of a membership fee entitling them to Life Membership and the amount thereof; or dependent upon the payment of Annual Dues and the amount thereof as follows:

(1) Life Members.
(2) Contributing Members.
(3) Annual Members.

Life members shall pay a Membership fee as set forth in Article VIII, Section 1 but shall not pay annual dues. All other members shall pay annual dues as set forth in Article VIII, Section 1.

Section 3. Privileges. Each member in good standing shall be entitled to one vote. Each member in good standing shall be entitled to receive one copy of *Textile Research* whenever published. Contributing members shall be entitled to participate in any co-operative research project conducted by the Institute by subscribing, for each such co-operative research project which it desires to support, $100.00 annually or such other sum or apportionment as may be specified by the Directors. Such subscription will entitle the co-operator to receive reports of each research subscribed to, as rapidly as issued. Such reports on research projects become available for publication in *Textile Research* or elsewhere one year after they have been issued to subscribers.

(*Section 4* (Old Section 3), and *Section 5* (Old Section 4), unchanged.)

Section 6. Qualification. Life members shall qualify by the payment of their membership fees, and unless such payment, or the first in-

stallment thereof, shall be made within thirty days after notification to the member of election, such election shall be void. Contributing Members and Annual Members shall qualify by payment of dues.

(*Section 7* (Old Section 6); *Section 8* (Old Section 7); and *Section 9* (Old Section 8), unchanged.)

Article II

Section 1. Enumeration of Officers. The officers of this corporation shall be a President, two Vice-Presidents, a Treasurer, who must be members of the Board of Directors, a Secretary, and such assistants or other officers as may be from time to time appointed or elected by the Board of Directors.

Section 2. Enumeration of Committees. There shall be three standing or permanent committees: one designated as the "Executive Committee," which shall consist of not more than twelve (12) members and the President ex-officio; another designated as the "Board of Trustees," which shall consist of six (6) members and the President ex-officio; another designated as the "Research Council," which shall consist of not less than five (5) members.

(*Section 3* and *Section 4*, unchanged.)

Section 5. Election of Committees. (a) Same as Old Section 5 (a) with the addition of "The Director who is the chairman of the 'Research Council' shall be a member of the Executive Committee."

(b) Election of Board of Trustees. After the election of the directors by the members at the first meeting of United States Institute for Textile Research, following the adoption of these by-laws, the members of the Board of Trustees shall be elected by the Board of Directors at its first regular meeting. Thereafter the members of the Board of Trustees shall fill vacancies in the Board, and unanimous vote of members of the Board in person or by proxy shall be necessary to elect. Qualification for election to the Board of Trustees shall be Life Membership in the Corporation. Should no members of this class be available when a vacancy occurs in the Board of Trustees the vacancy shall be filled by election of a member of the Board of Directors, the election to be by unanimous vote of the Trustees in person or by proxy at a regular meeting of the Board of Trustees; a trustee thus elected shall cease to be a member of the Board of Trustees as soon as a Life Member of the Corporation regularly qualifying for membership in the Board of Trustees becomes available and is elected to the Board.

(c) Election of Research Council. The chairman of the Research Council who must be a director shall be elected annually by the Board of Directors. Membership in the Research Council shall be by appointment by the chairman after approval by the Board of Directors.

[(d) Unchanged. *Section 6*, unchanged.]

Article III

(*Section 1*, unchanged.)

Section 2. Vice-Presidents. There shall be a first and second Vice-President. The first Vice-President shall perform the duties of the President in the case of his absence or disability, and, in case of the absence or disability of the first Vice-President, the President's duties shall devolve upon the second Vice-President.

(*Sections 3, 4, 5, and 6*, unchanged.)

Article IV

(*Sections 1, 2, and 3*, unchanged.

Section 4. Research Council. The Research Council shall be responsible for the initiation and conduct of all research activities undertaken by the Institute.

(Articles V, VI and VII unchanged.)

Article VIII

Section 1. Membership Fees and Dues. Life Members shall qualify for membership by paying a membership fee of not less than $1,000.00. Contributing Members shall pay annual dues in the sum of $50.00. Annual Members shall pay annual dues in the sum of $10.00.

(*Sections 2, 3, 4, 5, 6, and 7*, unchanged.)

(Articles IX and X, unchanged.)

The Luncheon to Messrs. Nasmith and Goodall

SOME 75 members and guests of U. S. Institute for Textile Research attended the luncheon in honor of Frank Nasmith and J. R. S. Goodall, of The Textile Institute, Manchester, Eng. Co-operating with U. S. Institute in honoring the English guests were the heads of many of the industry's associations of manufacturers, merchants and technicians, and the number would have been larger had not the pending wage-hour bill necessitated the presence of several in Washington. The association heads in attendance as guests were the following: Franklin W. Hobbs, chairman, The Textile Foundation; Arthur Besse, president, National Association of Wool Manufacturers; W. Ray Bell, president, Association of Cotton Textile Merchants of New York; W. P. Fickett, president, Textile Fabrics Association; Josef Pollack, president, Cotton Thread Institute; R. D. Jenkins, vice-president, International Silk Guild; William Rossmaller, president, and George A. Urlaub, executive director, Throwsters Research Institute; William J. Matthews, chairman, National Association of Finishers of Textile Fabrics; Dr. Joseph F. X. Harold, president, American Association of Textile Technologists. Among the members of U. S. Institute who attended the luncheon were several additional officials of textile associations.

The luncheon was served at round tables, thus allowing those present to be seated in congenial groups. Messrs. Nasmith, Goodall and other guests were seated with officers of U. S. Institute at two adjoining tables, instead of at a formal head table. In fact, the gathering and the speech making were informal in character, as was the reception to the English guests before and after the luncheon. Acting-President Killheffer was aided in introducing members and guests by Dr. H. DeWitt Smith, who was secretary of the committee of United States members of The Textile Institute which arranged the itinerary and program for the visit of Messrs. Nasmith and Goodall. U. S. Institute's luncheon was the largest, and the most representative of the country's textile interests that was on their itinerary, and provided contacts with the officers and members of many of the organizations which entertained them later.

The principal speaker at the luncheon was Mr. Nasmith, who was introduced briefly by Acting-President Killheffer, and who explained in some detail the organization, history, objectives and work of The Textile Institute, and the purposes of his visit to this country and Canada. He was followed by Mr. Goodall, but the lateness of the hour prevented the latter from presenting more than an outline of the work and objectives of the Diplomas Committee of which he is chairman. He stated that the members of his committee included the directors of the British research associations for the textile industry, who are men of unquestioned ability, but also of positive opinions. Because of his somewhat independent position he was expected to compose their differences and bring about agreement. He drew hearty laughs when he stated that he had not been in this country long enough to learn whether its textile men found it difficult to agree, or were swayed by petty jealousies.

Mr. Nasmith's Address

FRANK NASMITH, J.P., F.T.I.
President, The Textile Institute, Manchester, Eng.

In his address Mr. Nasmith stated that, while from 1910 to the formation following the World War of the British research associations for the textile industry, The Textile Institute had engaged in the promotion and organization of scientific and industrial research with some noteworthy results, that activity was given over to those associations in 1918. Since then its textile educative work, which had been its most important activity from the start, has been greatly expanded. The granting of incorporation by Royal Charter in 1925 gave to The Textile Institute an outstanding position in textile educative work. The Charter not only allowed the Institute to grant diplomas and degrees, but dignified textile technology as a profession. The diplomas of the Institute are regarded as necessary for teachers in British textile schools and textile departments of the universities, and for admission to the practice of textile technology.

At the annual meeting of the Institute in Peebles, Scotland, this month the subject of textile education will be discussed from all angles by some of the leading British authorities, and it is expected that there will be

a further broadening and recognition of Institute authority in textile education. The lack of adequate and up-to-date textile text books is realized, and the Institute has a committee which is studying this problem and will report eventually on ways and means of preparing and publishing a series of text books.

The Institute has an extensive library, maintains an information service, and an employment bureau. It has a scholarship fund with an annual award to young men in the cotton industry. Its annual prize competition in fabric design is an important factor in stimulating greater proficiency in this art. In addition to its general conferences held semi-annually, it has several sections which meet more frequently, and which are operated independently with their own secretaries. Mr. Nasmith stated that it was hoped that a United States and a Canadian section might be formed. There are 56 Institute members in this country, of whom several have qualified for Textile Institute diplomas. The Canadian group is much smaller, but promises a substantial increase in members.

The speaker was justifiably proud of the character of and the international demand for the *Journal of the Textile Institute*. Issued monthly it contains the proceedings and transactions of the Institute, reports of contemporary researches, including such as may be released by the British textile research associations and the Technological Laboratory of the Indian Central Cotton Committee. Its abstracts section is the most complete survey of textile literature in the world, and is largely prepared by the British textile research associations. The Journal is free to members, and the subscription price to non-members is the same as members' annual dues.

One of the most recent activities to be entered upon by the Institute is the standardization of textiles and textile testing methods. Steps have already been taken looking toward the co-ordination of existing organized work of this kind in Great Britain under the aegis of the Institute. It is recognized that greater progress along these lines has taken place in this country, and it is hoped on this visit to contact the responsible organizations and learn at first hand of their policies and methods, and to encourage such co-operation as may be possible between the British and United States textile bodies responsible for such work. In textile standardization work, Mr. Nasmith pointed out, it is their policy to work from the producer down to the consumer, and to anticipate demand from the latter for standardization.

Mr. Nasmith stated that the Institute has a membership of over 1,800, and that he looks for this to increase to 5,000; also that its foundation fund of some £20,000 will eventually reach £50,000. (Applause.)

Frank Nasmith, J.P., F.T.I., is executive manager for Great Britain of the Universal Winding Co., and managing director of Unisel, Ltd., which represents several domestic textile supply companies in Great Britain. He was editor of the *Textile Recorder* for some 25 years, was honorable secretary to the British delegates to the World Cotton Conference in New Orleans in 1919, organized the World Cotton Conference at Liverpool and Manchester in 1921, and is chairman of the Board of Textile Recorder Exhibitions, Ltd. He was a member of the committee that formulated plans resulting in the organization in 1910 of The Textile Institute, and prior to his election as president had held the offices of honorary secretary and chairman of the council.

Official Visits of the Textile Institute Delegates

THE program for the official tour in this country of Frank Nasmith, president, and J. R. S. Goodall, chairman, Diplomas Committee of The Textile Institute, Manchester, Eng., was arranged by a committee of United States members, with Dr. H. DeWitt Smith as secretary. Dr. Smith not only performed most of the work in this connection, but personally conducted the delegates on many of their visits. The itinerary started May 23, and lasted, with only a few intervening days for rest, until June 2. It included conferences with textile technical associations, and visits to textile and technical schools, laboratories and government departments. The luncheon given in honor of the delegates by U. S. Institute was the largest and most representative of the industry in point of attendance.

Appropriately, the first reception of the delegates was by United States members of The Textile Institute. This was a luncheon at the Hotel St. Regis, New York, N. Y., and was attended by some 20 members. The same evening Messrs. Nasmith and Goodall were entertained at dinner at the Chemists' Club, New York City, by the Board of Governors of the American Association of Textile Technologists. President Jos. F. X. Harold welcomed the guests and presided over the speaking program. Mr. Nasmith explained the work of the Institute, with particular emphasis upon the provisions of its regulations under its Royal Charter applying to qualification and certification as "textile technologists."

On Tuesday, May 24, the delegates visited the office of the American Standards Association before attending the luncheon given in their honor by U. S. Institute, and afterward met officers of the Textile Section of the A. S. M. E. at their rooms in the Engineering Societies Building. The remainder of the itinerary of visits and meetings was as follows:

On Thursday, May 26, the delegates visited the textile laboratories of Massachusetts Institute of Technology, Cambridge, Mass., and were entertained at luncheon by President Karl T. Compton. Attending the latter function also were members of the Corporation's visiting committee on textiles, and members of the faculty interested in textiles. In the afternoon Messrs. Nasmith and Goodall were the guests of President Charles H. Eames of Lowell (Mass.) Textile Institute, and in the evening conferred with officers of Committee D–13 of the American Society for Testing Materials at the Vesper Country Club, Lowell, where they were the dinner guests of Prof. H. J. Ball, chairman of Committee D–13.

On Friday evening, May 27, they were in Montreal for a private dinner at the Windsor Hotel given in their honor by The Textile Society of Canada (Eastern Division).

Tuesday, May 31, found the visitors back in this country for several visits and conferences in Washington, D. C. They spent the morning at the National Bureau of Standards, inspecting the laboratories and conferring with members of the staff. They had lunch with Fredk. M. Feiker, director of The Textile Foundation's textile educational program. The afternoon was spent at the laboratories of the Cotton Marketing Division, Bureau of Agricultural Economics, Department of Agriculture.

The last official function was a luncheon given in honor of the visitors by the officers and council of the American Association of Textile Chemists and Colorists at the Chemists' Club, New York, N. Y., on Wednesday, June 1.

The Possibilities and Limitations of the Spinning Test as a Means of Determining Cotton Quality*

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Introduction

TOO many people who are interested in cotton for one reason or another, the factor of quality or utility appears to be one that can be quickly determined and accurately described by the cotton classer, or by the "laboratory worker." If by chance these people understand that there are as yet many limitations to the ability of the classer or scientific investigator to pigeonhole the facts of cotton quality, quickly and accurately, frequently even then the view is held that a spinning test is the real solution.

As they see it, a sample of cotton (ranging in size from a few ounces to fifty bales) is dumped into the first machine of a cotton mill; the wheels turn and a few hours later out comes the finished product. It then remains only to test a few samples of the yarn or cloth, and say where in the orderly and simple category of quality that particular cotton belongs. This is the popular conception of a spinning test. The difficulty is that this view is not infrequently held by persons of some influence in textiles, who for one reason or another wish to know the quality of cottons they find on their hands.

Unfortunately, the matter is not so simple as the popular conception would have it. The results obtained from carefully-conducted spinning tests are of a highly complex nature, and the investigator soon finds himself well into the field of physics and mathematics. Even then, the significance of spinning test results is frequently difficult and sometimes impossible to determine. Unexplainable paradoxes quickly show the newcomer in spinning research work that the spinning test is not a cut-and-dried affair.

The consideration of a somewhat analogous investigation into the quality of a substance other than cotton may throw light on the type of problem which confronts one in a spinning test. For example, standard routine laboratory tests have been established for determining the value of coal as a fuel. The investigator prepares his sample, and by a sequence of routine tests determines the percentages of moisture, volatile combustible matter, and ash. The application of a formula gives the number of B. t. u.'s per pound of this coal. The higher the number, the greater the efficiency of the coal as a fuel is considered to be. These tests may be compared roughly to laboratory tests on the cotton fibre. The chief difference is that for cotton fibre, "B. t. u.'s" are not available for definitely indicating the value.

* This paper relates to a part of the program of work on cotton utility and standards research under the leadership of Robert W. Webb, Principal Cotton Technologist, Bureau of Agricultural Economics, U. S. Department of Agriculture.

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Suppose, however, that the coal investigator is not satisfied with his laboratory test of the coal sample, and decides to conduct a "practical" test of the coal. The procedure then is more like the spinning test. A boiler in the power-house is cleaned. Coal is weighed out for the test, a fire built, and the coal shoveled into the furnace in the usual way. Steam pressure is developed in the boiler, and the flywheel of a steam engine begins to turn in the engine room. The investigator takes a series of indicator-cards and calculates the horsepower developed. The period of time for which the sample of coal develops this power is recorded. From these data the work done by the engine is calculated. The ashes are drawn from the fire-box and weighed. To what extent can the investigator consider that he has a true and complete measurement of the quality of the sample of coal?

The illustration given is not exactly parallel to a spinning test since actual samples of the original cotton are transformed into yarn, cord, or cloth and the result is tested, whereas the coal, as such, got no farther than the fire-box of the boiler, the study being made primarily upon the steam pressure that it generated. Nevertheless, the main point in the problem has been brought to the surface. How much does the figure for weight of ashes depend upon the type of grate, the method of firing, and the kind and degree of draft? How much does the figure for work done depend upon these same factors, and innumerable others—friction in steam pipes, speed of engine, atmospheric pressure, setting and timing of intake and exhaust valves? In short, to what extent has it been a test of the efficiency of the boiler and engine and their operation, and to what extent a test of the particular sample of coal? It is not difficult to see that if conditions in this coal test had differed, the results would have differed.

A parallel question thus suggests itself with respect to the spinning test as a means of determining cotton quality: To what extent are the results a measure of manufacturing conditions and machines, and to what extent are they an index of the quality of the cotton tested?

It is the purpose of this paper to discuss the possibilities and limitations of the spinning test as a method of determining the quality or "spinning utility" of cotton, and to show, in part, what has been accomplished and what remains to be done toward making the spinning test a sound and efficient means of measuring cotton quality.

Objects of Spinning Tests

Spinning tests may be divided into two categories, namely, (1) mill tests, and (2) laboratory tests. The purposes for which spinning tests may be conducted are many, and the specific ones depend chiefly upon the mill or laboratory in which the work is done; that is, their interests, equipment, and personnel.

Commercial plants occasionally test a particular cotton to learn whether it is suitable for a specific purpose. The data gained in such tests are for "home consumption" only, and are not ordinarily published. In some cases, however, investigators conduct mill spinning tests with the object of estimating the relative merits and demerits of one or more cottons, and in such cases it is not unusual for the results to be published.

Laboratory spinning tests may be conducted for various purposes. They include evaluating available cotton standards, studying new varieties or strains of cotton, measuring the influence of growth conditions, or harvesting or ginning methods.

They may be employed to evaluate differences in fibre properties measured in the fibre laboratory. The ultimate goal of much of this latter type of research is to establish an equation for predicting the spinning quality of cotton from measurements of the various fibre properties. Just how far it will be possible to go toward the attainment of this end is a point for conjecture at the present time. It is clear, however, that progress can be made only by careful study of the properties of the fibres, and of the materials manufactured from them, and that only by studying fibre and yarn relationships in both average and extreme cases will the part played by the various fibre properties in influencing the spinning utility eventually be determined.

Types of Spinning Tests

Both mill and laboratory tests are useful. The chief differences are in the size of sample employed, the degree of precision obtainable in the conditions of manufacture, and the care usually exercised in supervising the tests. Brief consideration will be given to these two types of spinning tests.

The material employed in a mill test is usually similar to the cotton regularly manufactured in that particular plant. The size of the sample may vary from one to ten or more bales of cotton per lot. The spinning plan used is in most cases the same as that regularly employed in the mill, so the material made in the course of the test may be absorbed later in the regular production. Otherwise, it would be too expensive to spin a large sample for test purposes.

Regular operatives of the mill usually perform the actual labor of handling the cotton, "creeling" the machines and operating them. The work of supervising the tests, making the necessary weighings and measurements, and keeping the records, may be delegated to one person, or to various individuals in the different departments of the mill. The precision of the tests depends to a considerable extent upon this supervision, which varies a great deal in effectiveness among different mills where spinning tests are conducted.

Testing of the yarns may be done in the laboratory at the mill, if it has one, or at some other laboratory. Conditions vary greatly in mill laboratories. In some instances, provision is made for accurate humidity control, and the testing machines are kept in good order and are carefully calibrated at frequent intervals. Precision balances are to be found in the best laboratories. At the other extreme are dirty, ill-kept rooms, sometimes referred to as testing laboratories, in which may be found an old-style hand-operated skein tester, a crude inaccurate pair of yarn scales, and humidifiers that are generally out of order. Or perhaps there are no humidifiers.

The shortcomings of work done under such circumstances are not hard to guess. Nothing must interrupt the regular production of the mill; so the test is conducted under such conditions and at such times as the circumstances permit. The test is thus placed at a disadvantage from the start, with the result that there is little time for obtaining accurate machine settings and proper determination of size of stock. The mill operatives who actually operate the machines are not acquainted with the purpose for which the test is being conducted, and by countless means may vitiate the results, either because they are careless or because they are unaware. While most of the better mills are equipped with humidifiers in the card and spinning rooms, local control of a precision nature is usually out of the question. An important variable is thus injected into the test which may have a considerable influence on the results. The value of the average mill test suffers greatly from lack of careful, constant supervision. Too much dependence is placed

on the word of employees who are not trained for this specialized work, and who understand neither the objectives of such tests nor the problems involved.

The circumstances under which the best laboratory spinning tests are conducted are vastly different, and are such as to avoid the shortcomings of a mill test. A trained staff of technical people, who work uninterruptedly on tests of this nature only, handle the material from start to finish, on machines that are used for this purpose alone and that are carefully set and adjusted. When measurements of fibre length and other properties determined in the fibre laboratory are available, the machine settings, twists, and other factors are based on them. Precise measurements and observations made at frequent periods during processing enable the supervisor to keep a careful check on the cotton at all times.

As little as two pounds of cotton may be used. At a well-known English spinning laboratory the standard size of sample is 2½ pounds. This laboratory, however, is concerned almost entirely with the appearance and strength of a single count of yarn of very limited use. No attention is given to picker and card waste, for data on such small samples would be quite unreliable. In tests where quantity and quality of waste are important considerations, and where a wide range of counts and twists of both carded and combed yarns may be desirable, at least 40 pounds of lint should be used.

In order to obtain a complete picture of yarn quality, it is necessary to spin a relatively wide range of counts and twists of yarn. The amount of spinning necessary varies considerably, depending upon the purpose of the particular study. In some cases, where only simple comparative results are desired, the range of yarns spun can be quite limited. In others, it may be necessary to spin 100 or more doffs of yarn from the same cotton to obtain the desired picture.

One of the greatest advantages of a laboratory spinning test over a commercial mill test is the greater degree of control of factors during the whole manufacturing process. Although the machines in the laboratory are usually of commercial design and construction, cut down in length in some cases to suit the needs and space requirements of the laboratory, they are kept much cleaner and in better condition. In view of these facts, it is clear that settings may be made with much greater precision in the laboratory. Special facilities for measuring lengths of stock and for controlling speeds are used on many laboratory machines. Equipment for the accurate control of relative humidity and, in some cases, of temperature are provided.

At the spinning laboratories of the Bureau of Agricultural Economics, the organization and settings to be employed are carefully selected with particular regard to the cotton being tested. Settings, twists, and the like are chosen to bring out the full possibilities of the cotton in so far as this can be done with information available at present. Precise weighings are made of stock and of each type of waste at each machine in which cleaning is a function. These data form the basis for waste studies. Frequent sizings are made at all processes to ensure that the desired weights are being made, and to provide a basis for studying the variability of the size of stock at every process. Photographs of stock and waste are made at many points, providing permanent records for use in studying manufacturing characteristics. Samples of stock and waste are held for studies at the fibre laboratory.

The yarns spun at the Bureau's laboratories are marked for identification, and later tested under controlled atmospheric conditions for size, skein strength, single strand strength, and moisture regain. In many cases, other tests of special nature are conducted. Samples of a standard construction of tire cord

are also made from each cotton in most instances, and laboratory tests are made upon them.

Considerable attention is being given to the appearance of the yarns spun from each cotton tested. Samples are wound on special boards, forming a semi-permanent record that can be studied carefully when the report of the test is being prepared.

A recent development has been the design and construction of a slasher for the preparation of very small warps, and the adaptation of a special narrow loom for weaving a few ounces of yarn into cloth. The samples of fabric made by this means are later subjected to a variety of tests. Consideration is now being given to the use of bleaching, dyeing, and finishing units which will permit the handling and treatment of very small samples of cloth.

Members of the spinning staff are trained to watch the behavior of the test cotton at each process and to make note of any unusual features observed. At the same time, an attempt is made to determine, if possible, the causes of faulty or unusual behavior, with a view to throwing light on the quality of the sample being subjected to the spinning test.

A record is kept of the rate of end breakage at the spinning frame during the spinning of each count and twist of yarn, providing a measure of importance in the consideration of relative spinning quality of a cotton.

Spinning Test Criteria

The measures of quality sought in connection with the spinning or manufacturing test are varied, and depend largely upon the specific purpose of the test and the conditions under which the work is done.

In some spinning laboratories, emphasis is placed on comparative rather than on absolute measures of quality. Such laboratories employ control samples with each test, and a new cotton is thus found to be better than, equal to, or inferior to the control sample. Thus, within certain limits a sample can be compared by inference with others previously spun and compared with samples of the same control cotton. Work of this kind is being conducted at two well-known English spinning laboratories.

For other purposes, however, it is more desirable to place the results on an absolute basis, since one of the chief objectives is to obtain a clearer understanding of the relationships of the properties of the fibres with those of the products manufactured from them. At the same time, it is desirable to know where a particular cotton stands in the scale of quality, and to provide stable bases for comparison. Use is now being made by the Bureau of an accumulation of data regarding waste and yarn strength developed in connection with the work of this project over a period of about eight or nine years. A series of charts show the average percentage of each type of waste removed from each grade of cotton during the manufacture of carded yarn. A nomograph gives the strength that may be expected, on an average, from any count of warp yarn that may be spun from any staple length of cotton, covering a considerable range of both yarn count and staple length. With the use of these nomographs it is possible to make a quick comparison of the results of a test of a single cotton, and thus to determine whether it is of inferior, average, or superior spinning quality.

The factor of yarn strength is undoubtedly the most widely-used criterion of quality obtained from the spinning test. Probably more attention has been given to the development of methods for obtaining yarn strength than to any other measure; consequently it is now a relatively well-accepted test.

Most American and English mills and laboratories employ the skein test, although some use is also made of single-strand strength measurements. In continental Europe, on the other hand, the single-strand test seems to be in greatest favor.

The so-called "ballistic" tester is found in many English laboratories, but few if any are used at the present time in this country. With the use of this device it is possible to measure the "work of rupture" expended in snapping a specimen of yarn, cord, or cloth.

An instrument has recently been placed on the market in this country for use in determining the elasticity and permanent elongation for given loads, the tensile strength of the specimen, and the effects of repeated stress or "fatigue" upon these factors.

Rates of end breakage, appearance (that is, uniformity, freedom from neps and particles of foreign matter), uniformity of diameter or "levelness" of yarns, resistance to abrasion, and winding efficiency are some of the other tests employed to determine yarn quality. Fabrics woven or knitted from such yarns may likewise be tested for tensile and bursting strength, resistance to abrasion and tearing, air and water permeability, dyeing and finishing properties, launderability, serviceability, and the like.

The Bureau's spinning laboratories possess a large file of carded and combed yarns from many different cottons. From these, together with samples of yarn obtained from a number of mills, a series of photographic standards for yarn appearance have been developed. Yarns made in the course of spinning tests are wound on boards, compared with these standards, and graded accordingly.

All of the tests mentioned provide data which reflect, to some extent at least, the quality of the raw cotton employed.

Variables Encountered in Spinning Tests

At the beginning of this paper it was pointed out that the spinning test is not the cut-and-dried affair that it is popularly supposed to be. Now that a description has been given of the "why" and the "how" of the spinning test, it is necessary to consider the "ifs" and the "buts" involved.

If, in comparing two or more cottons in a spinning test, the investigator could be certain that he had the optimum combination for each, the matter would be simple. Unfortunately it is possible to employ widely different settings, speeds, and other factors, without producing visible changes in the quality of the product, so that the results of employing a particular combination may not be known until the end product is tested. The number of variables to be considered in a spinning test (spinning organization, speeds, settings, and the like) is very large, and it is clear that the possible combinations are practically infinite.

Let it be supposed that there are 100 points in the manufacturing process where a condition may be varied; as, for example, card licker-in speeds, drawing-frame drafts, roving twists, spinning-frame roll settings, etc. Let it be further supposed that there are 10 different values for each variable. What combination of variables should be used for a given cotton so that the resulting product is certain to be as nearly perfect as it can be made?

A little calculating of permutations and combinations shows that the number of possible combinations is 10 raised to the 100th power, or 1 followed by 100 zeros. But, although there are probably several million different routes that a man can take between his home and his office, without leaving

the city, is it necessary for him to test out each and every one of the routes before determining which is the best for him to follow?

Solution of the Problem

Just as an individual soon settles upon a route which he considers best for his purposes, so, by breaking the problem of spinning variables into manageable segments and making a study of the effects of the more important ones encountered, mixing in a liberal amount of judgment during the process, it should be possible eventually to conduct a spinning test and say with a good deal of conviction where a particular cotton stands with respect to quality.

A number of years ago, this theory was judged by those concerned in the U. S. Department of Agriculture to be a sound one, and a start was made on the problem. In addition to the spinning tests of a more or less routine nature, there was established at the spinning laboratory a program of fundamental studies. One of the purposes of this work is to arrive at a better understanding of some of the more important variables and to apply this information in such a manner as to give a high degree of reliability to the results of spinning tests.

These fundamental studies have yielded information relating to machine speeds, settings, drafts, twists and other factors, both single and in various combinations. From this information it has been possible to establish many facts regarding the influence of these variables upon the quality of the product. In some cases it has been found that within the range of working conditions the differences are insignificant and may be ignored; in others, the variables must be considered carefully. Correction factors have been developed which can be applied to the test data to eliminate the influence of certain variables.

On the basis of some of the findings it has been possible to establish equations between the values for certain fibre properties and the settings or other adjustments on the machines. It has been found that the optimum yarn twist, from the standpoint of strength, depends upon the length of staple, other factors being equal. An equation showing the relationship of optimum twist to the length of fibre at a particular point in the fibre length array has been developed and put into use.

Space prevents a description here of the findings which have resulted from these fundamental studies. It is sufficient to say that as a result of this work it has been possible to make substantial improvements in the technic of routine spinning tests, and that it is now possible to assign causes for and to evaluate many if not most of the differences in results which are due to manufacturing conditions rather than to differences in cotton quality.

Increasing use is being made of modern statistical methods in sampling, compiling, and analyzing spinning test data. Wherever feasible, special applications of correlation, variance analysis, and other tests of the significance of differences have been developed and put to frequent use.

With improved laboratory technic and modern methods of analysis, spinning tests can now be conducted with greater confidence and the results interpreted more intelligently than heretofore. Nothing can take the place of the spinning test, *properly conducted under adequate conditions*, to give a measure of the utility of a cotton, but even this method is as yet by no means perfect. Continued effort is being made to increase its reliability and to develop short-cut methods which will speed up the tests, increase the number of samples that can be handled and lessen the expense involved without sacrifice in precision of results.

Fundamental Properties of Textile Wastes. IV. Flotation

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A Textile Foundation Publication

General Problem and History

THE flotation process of concentrating ores has grown to immense proportions since the first patent was granted in 1860. The application of the principle has been confined mainly to the mining industry, but it has occurred to us that it may be used in ridding textile wastes of colloids or particles of like dimensions.

The history of flotation as an art can be easily followed through a survey of the patents granted. William Haynes,[12] in 1860, recognized the difference in wettability of minerals by water and secured a separation of sulfides by triturating the dry-ground ore with an oily agent and agitating with water. Working on the same idea, Everson [12] acidulated the pulp and was granted a patent on the process in 1885. Until 1903 the selection and flotation of ore were characterized by this advance of Everson.

The next step forward was flotation with gas a buoyant medium. Delprat,[12] Potter,[12] and Froment [12] were granted patents for this innovation. It became unnecessary, even detrimental, to use large amounts of oil. Further investigations proved that different oils gave varying results with the same ore. Greenway, Sulman and Higgins[12] recommended the use of such soluble frothing agents as ketones, fatty acids, and esters.

Flotation now left the "bulk-oil-era" and entered the "chemical" stage. Perkins [12] discovered the fact that nitrogen in the trivalent stage and sulfur in the divalent stage, in certain non-oleaginous compounds, possessed definite collecting properties. Later work by Keller,[12] in 1924, proved some of the soluble xanthates to be good collecting agents. Reagents are known to increase the flotability of certain minerals and decrease it in other cases. Yields were increased by making the circuit alkaline. The future of flotation points toward selective flotation.

The most widely used machines in flotation are the agitation and pneumatic types. The Mineral Separation Company's agitation machine [12] consists essentially of eight to sixteen cells arranged in series. Each cell consists of an agitation department with a cross-blade, vertical impellor, rotating at high speed and drawing air into the pulp by the vortex which it forms. The Callow pneumatic machine is simple in design and economical in cost. It is a sloping trough with a canvas covered bottom through which air is forced by a blower or compressor. The McIntosh machine has a canvas covered rotor through which the air is forced while

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it rotates. Some of the difficulties experienced in the operation of the Callow cell are overcome in this way.

Theoretical Explanation

Flotation is a mining process developed by men interested in it from a practical point of view. The literature is filled with technical articles on the subject, but only in recent years has theoretical explanation been attempted. It is interesting that opinions do not differ as much as might be expected. Usually it is a difference of degree that is involved and not really the fundamental idea.

Flotation is a surface phenomenon and the chemistry involved is surface chemistry. There are three phases involved: the gaseous, the liquid, and the solid. These may be discussed briefly in the order named.

The gaseous phase might seem the most important, as it is the bubbles which float the particles through their buoyant effect. This important effect is perhaps overemphasized in the earliest works. Gaudin [12] and Taggart [25] say that the gas phase may be considered, for all practical purposes, as a vacuum to which floatable particles might become attached. Except in those cases where the gas may react with the ore or change the pH of the solution, the composition of the gas is of little importance.

The liquid phase is more complex than the gaseous phase because of the dissolved materials already present or added during the process. Water, because of its availability, its inexpensiveness, its high polarity, and high surface tension is used almost exclusively. The literature reports no experiments using any other medium but it would be interesting to know what might be found.

The most complex phase is the solid. The complexity arises from the fact that one is not dealing with a single phase usually, but with several mineral species of varying degrees of size, polarity, and ionization.

Flotation would not be the successful process that it is without the use of various agents to facilitate the process, and consideration must be given them. Attempts to produce froth in a pure liquid result in large coarse bubbles which break upon reaching the surface. Frothing agents or frothers are added to produce the foam layer with the desired consistency. Gaudin,[12] Taggart,[25] Bartsch,[3] and del Guidice [6] seem to agree very well on the characteristics and actions of the frother. By changing the surface tension, a stable froth is produced. The most desirable agent is usually an organic, heteropolar compound containing from five to eight carbon atoms. The polar groups present, in order of their frequency of occurrence are: OH, CO, COO, CONH, and COC. Organic molecules lower the surface tension and, following Gibbs' adsorption equation, $u = -\frac{c}{RT}\cdot\frac{dx}{dc}$ where u represents the adsorption of the dissolved substance in the boundary layer, c is the concentration in any convenient unit, R is the gas constant in ergs per degree centigrade, T is absolute temperature, and x is the surface tension, the concentration must be greater in the surface layer. Thus, with a small concentration of reagent a great change can be made in the surface tension. The formation of the froth is usually a process of draining water from between the bubbles with some coalescing occurring as they reach the surface. Prepared particles attach themselves in a single layer to these rising bubbles. The greatest amount of

collecting occurs near or in the surface layer. These collected particles lend stability to the bubbles even to such an extent that they may be removed, dried, and the encrustation photographed.

Ostwald [15, 19, 20] repeatedly stresses the statement of Mayer that particles wettable by water will not float. Gaudin [12] says that the polarity or non-polarity of substances controls their being wetted or not wetted and their flotability. Collecting agents added to the flotation system are designed to prepare the surface of the ore so it will become unwettable. With bulk oil flotation certain oils produce better yields. Taggart, Taylor and Ince [26] thought the oil selectively coated the sulfides and the air bubbles adhered to the oily surface. A different explanation is necessary in the case of soluble collectors. No theory has received more attention than the chemical theory which postulates the formation of an insoluble compound, produced by a metathetical reaction between the collector and the surface upon which it is adsorbed. The molecule of the collector is composed of a polar and a non-polar group as is the frother, the difference being that the polar group of the collector is active. This active polar group reacts with the mineral exposing a hydrophobic non-polar group to the water, and consequently flotation can be obtained. It seems likely that the action of the xanthates can be explained in the same manner as that of the activators; namely, that a more insoluble substance is formed at the surface of the mineral. Contact with air becomes possible at about the concentrations of the metal and xanthate ions at which precipitates of metal xanthates are more soluble than the sulfide surfaces upon which they are absorbed. Gaudin, Hayes and Haas [14] found certain amines floated sphalerite, though no insoluble sulfide or zinc salts are formed by them. The selective adsorption of oils can hardly be explained by chemical action. Taggart [25] thinks, according to the law of least energy, that the energy of the oil-sulfide interface must be less than the energy of the oil-water interface. Ostwald [18, 19, 20] says that the collector should be triphilic and the amount added would not be sufficient to give a monomolecular layer. The explanation then must be a monomolecular ring, bound in such a way that it is capable of vibrating over the entire particle. Kellerman,[17] Weineg and Palmer [36] agree that a monomolecular layer of collector over the entire surface is unnecessary. However, Wark,[31] and Siedler, Moeller and Reddehase [23] point out that the tenacity of the layer would indicate no such ring structure.

Another class of reagents to be dealt with is the activator and the depressor. The activator prepares the surface of the ore so it will in turn react with the collector. The depressor obviously is added for just the opposite purpose. Wark and Wark,[32] Fahrenwald,[9] and del Guidice [7] have investigated the cause or nature of the action and agree that it must be explained by a reaction between the reagent and the mineral.

Ordinarily it would be expected that the coarser the particle the more difficult the flotation, whether the particle be polar or non-polar. This is true for non-polar particles but not for polar particles. It was thought that the fineness of size would permit more rapid oxidation, making the particle unfloatable. Gaudin [12] performed experiments eliminating this possibility and secured no flotation. He set his size limits for good flotation between five and 500 microns. Wark [28] cautions that particles may have projecting edges or more than one face in the interface which migh allow a large particle to be floated. In considering dispersion and flocculation, Edser [8]

and Sulman [24] state that deflocculated substances will not float. Bartsch [4] says a flocculent aggregate must be present and Patek [21] points out that colloids coat the particles preventing proper coagulation and good flotation. Wark [34] is inclined to think that dispersion itself is no bar to good flotation but that conditions leading to such dispersion are a hindrance.

At the line of contact between the three phases there exists a definite angle between the bubble and the mineral surface. Freundlich [11] says that this angle is essential to flotation, but no headway could be made into the problem from this approach because of the difficulty of making accurate measurements and the changeableness of the angle upon any disturbance. In the equation given by Wark,[28, 34] T_{wa} $(1 - \cos \theta)$, where T_{wa} is the surface tension of the water and θ is the angle of contact, is a measure of the force for replacing the mineral water by a mineral air contact. Both T_{wa} and θ can be measured accurately. There is a hysteresis of the angle, observed by Parsons and Anderson [22] and by other observers. Sulman [24] believes that no flotation could be secured without this effect. It is also interesting to note the relationship between the angle of contact and the constitution of the molecule. Wark and Wark [30] found the angle of contact to be independent of the mineral and probably dependent on the non-polar group. This they deduced from changes observed in the angle when collectors of a homologous series were used. Gaudin [15] agrees that the angle of contact has quite a bit to do with the floatability of a mineral but does not think the process can be explained entirely in this manner.

To float, the solid must come in contact with and become attached to a gas bubble. There is some doubt whether the adhesion is caused by the particle and bubble coming in contact or by a precipitation of the dissolved gas onto the solid. Welsh [35] conceived the idea that perhaps the whole phenomenon of flotation could be explained by chemical activity in which the gas would result from a surface reaction between the solid and the reagents added or already present in the circuit. The selective flotation would become nothing more than selective chemical activity. Taggart [25] considers the attachment of the solid and the bubble to be similar to that of the needle and water when a needle is floated by surface tension of the water. However, the particle seem to be in the oily interface between the oil and the surrounding water. Attempts to explain the adhesion by electrostatics have met with varied success. Bain [1, 2] thinks the bubbles possess a very slight charge which is opposite that of the gangue and slime. The bubbles become coated with the slime and gangue and then attract the sulfide particles. By the addition of a few drops of HNO_3 he found that he could reverse the charge on the bubbles and attract the sulfides while repelling the slime and gangue. Taylor, Nelson and Bull [27] explain the cation effect on galena by electrostatics, but Taylor states definitely in discussion of Gaudin's paper [13] that the adherance of mineral matter is not due to electrostatics but involves a reaction with the collector. Kamienski [16] noted a sharp fall in potential on unattackable electrodes of platinum, galena, and graphite when terpinol and xantogenticum were added. He suggests that the adsorption of certain organic compounds onto the electrode surface is due to the electrostatic attraction between them and the globules of emulsion formed by the organic compound. Wark [33] says the drop in potential would indicate there was adsorption of xanthate ions. Because the separation of different metals

could be secured at different pH values, Frederick [10] reasons that there must be some connection between electrostatics and flotation. Bartsch [4] measured the charges on the mineral, the gangue, the slime, and the bubble and found them all to be negative. He attempts to explain the adhesion by some unusual capillary action.

Summary

It is apparent that flotation cannot be explained by considering alone any one phase of the problem. To float a solid mineral, it appears that there must be a liquid and a gaseous medium. To the water medium we add a non-ionizing, heteropolar compound which depresses the surface tension of the water, making the formation of a stable foam possible. Perhaps, always, the surface viscosity must be increased for the formation of a stable foam. If need be, the solid substance is conditioned. Then a heteropolar, ionizable organic compound is added as a collector. This may form a unimolecular film over the surface of the mineral, making it water repellant. Then by some force, perhaps electrostatic, or by some relationship between the tensions of the three phases, the particle adheres to the bubble and is carried to the surface where it is collected in the foam.

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Abstracts

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Address, C. H. Clark, Sec., 65 Franklin St., Boston, Mass.

I. Fibres (Synthetic and Natural) and Fibre Analysis

Lanital: Production. *Silk J. Rayon Wld.*, 1937, V. 14, No. 161, P. 22; abs. in *J. T. I.*, Jan. 1938, P. A5.

The casein solution is spun into hot sulphuric acid and the filaments are cut into staple fibre and then hardened by means of formalin. The fibre contains about 0.7% of sulphur. One hectolitre of skimmed milk yields about 3 kg. of casein and this 3 kg. of Lanital. Production in Jan.–July 1937, reached 770,500 kg. and the wholesale price was 20–21 lire per kg., against 25 lire for raw wool. The price of casein has increased from 2–3 lire per kg. in 1935 to 4–6 lire in 1937, but it is said that it pays Italy to import casein at this price rather than wool at 25 lire. (C)

Physical Characteristics of International Rayon Staple Fibres. *Rayon Tex. Mo.*, Feb. 1938, P. 69.

Tabulates the deniers, dry and wet tensile strength as well as per cent elongation of many staple fibres. The data were obtained from trustw rthy sources in literature during the past two or three years. (C)

Spectrochemical Research of Silk Solution. I. Ultraviolet Absorption of Cupro-ammonia Silk Solution. II. Absorption of Visible Ray of Cupro-ammonia Silk Solution. H. Sobue. *J. Soc. Text. Ind., Japan*, 1937, P. 127; abs. in *Rayon Tex. Mo.*, Feb. 1938, P. 105.

(I) The results may be summarized as follows: In the solutions of glycerine, pepton, gelatin and silk fibroin in the same cupro-ammonia so-

lutions, the spectrographs through the layer of the solutions were taken. From these photographs it is observed that the solutions of the longer peptide chains absorb the longer wave length in the ultraviolet region and the Hartley-Baly's curves of these solutions shift to the shorter wave lengthwise with the longer peptide chain. In the experimental region, the ultraviolet absorption is very little affected by the concentration of ammonia in the solution, and by means of the Hartley-Baly's curves. It is shown that the silk decomposition products by a hydrochloric acid contain various amino-compounds of long and short chains.

(II) The author reached the absorption of visible ray in cupro-ammonia solution by using a Nutting Spectrophotometer and the densities ($\log I - \log I_0$) of the light were measured, and the density-wave length curves in various cupro-ammonia silk solutions obtained. From these experimental results it is observed that the density-wave length curves of silk solutions shift to the shorter wave lengthwise and the thickness of layer increases the slope of the density-wave length curve. From the culculation of the extinction coefficients it is shown that the decomposition of silk fibroin in a Loewe's reagent is larger than that in a Schweitzer's solution. (C)

STAPLE FIBRE: TITRE AND COUNT DETERMINATIONS. E. Husung. *Monatsh. Seide. u. Kunstseide*, 1937, V. 42, P. 343–7, 391–3; abs. in *J. T. I.* Jan. 1938, P. A39.

The relation between denier and metric counts is discussel and various methods of determining the denier of staple fibre are described. The accuracy of the methods is discussed and their ranges of usefulness are compared. (C)

SWOLLEN VISCOSE FILAMENTS: ELASTIC PROPERTIES. P. H. Hermans and A. J. de Leeuw. *Naturwiss.*, 1937, V. 25, P. 524–5 (through *Chem. Zentr.*, 1937, ii, P. 2815); abs. in *J. T. I.*, Jan. 1938, P. A39.

Extensions have been measured on swollen viscose filaments containing 85–90% of water and the anisotropy of swelling, $Q = B/L$ (B = specific swelling in width and L = specific elongation) determined as a function of the degree of extension, v. The results can best be interpreted on the assumption of a net-like structure in the cellulose hydrate gel. On deformation, there is not so much a slipping of micelles over each other as a very considerable volume contraction due to the tightening up of the network. Micelles are postulated that are crystalline within but are outwardly irregular and bounded by numerous projecting, unordered cellobiose chains. (C)

WOOL LUBRICATION. S. Kershaw. *Rayon Tex. Mo.*, 1938, Jan., P. 55; Feb., P. 76. (C)

WOOL: RESEARCH NOTES ON. J. S. Brown. *Tex. Col.*, Feb. 1938, P. 83–5, 128.

It is unfortunate that this review of comparatively recent results of research on wool fibre structure emphasizes conclusions of W. Harrison (*J. T. I.*, *28*, 110), which differ radically from those of Astbury and Speakman, while failing to refer to answers of the latter authorities (*J. T. I.*, *28*, P394, P397) which reaffirm the accuracy of their previous findings. The balance of the article is also incomplete in its coverage and references. (C)

II. Yarns and Fabrics

Cloth: Strength Calculation from Yarn Strength. *Med. Rijksvoorl. Vezelhandel*, 1937, No. 50 (reprint from *Polytechnisch Weekblad*, 1937, V. 31, P. 1–7); abs. in *J. T. I.*, Jan. 1938, P. A42.

The connection between the strength of yarn and the strength of the cloth woven from it is given by the formula $B = f \times n \times b$, where B represents the strength of the cloth for a width of 5 cm., b is the breaking load of the yarn, n the number of threads per 5 cm., and f a variable factor that must be determined. Factors involved in the evaluation of f are discussed, special attention being paid to Kjellstrand's method for calculating the strength of cloth. The procedure that the manufacturer should follow when he has to make a cloth with a definite strength is outlined. Tables showing the influence of binding, the number of threads and friction upon the value of f for different weaves are given. Kjellstrand's table for cottons of single and twisted yarns for smooth and twill materials is included. (C)

Cottons and Rayons: Progress in Modern Finishing of. W. Kershaw. *Tex. Mfr.*, Feb. 1938, P. 81.

Recent progress in finishing has included machinery, control of processes, new chemicals and new properties of fabrics, including permanent treatments. (C)

Effect of Lighting on Output in Weaving. *Tex. Mfr.*, Feb. 1938, P. 57, 79.

An output and efficiency investigation using various arrangements, units and intensity of lighting in worsted weaving, including a German system for which high claims were made, but which did not compare favorably under the conditions. (C)

Shrinkage of Woolen Fabrics in Milling: Influence of Weave Structure on the. A. Johnson. *J. T. I.*, Feb. 1938, P. T7–T17.

Most of the processes subsequent to weaving to which woolen and worsted cloths are subjected have resulted from accumulated practical experience rather than the application of known scientific principles. Milling is no exception to this generalization. The correlation of the results of research into the structure of the wool fibre and the practical knowledge of the finisher has only recently begun. Recent work has proved the correctness of some of the processes found in practice by the trial and error method. The few known relations with any claim to precision are largely empirical. When the extremely complicated nature of the structure of a woven fabric is considered, this state of affairs is not surprising. In the research work here recorded, an effort has been made to evaluate one of the many factors which enter the phenomenon of milling, *viz.*, the weave structure.

From observations during the milling of cloths of various weaves it has been found that the results can be represented by an equation of the type $da/dt = k(x - a)$ where t = time in minutes, x = limiting percentage shrinkage, a = percentage area shrinkage at time t, k = a constant characteristic of the rate of shrinkage of the cloth. Such a comparison of weaves and their shrinkage on milling by means of the calculated values of x and k can be made more definite by milling each cloth to its limit. The success

attending this general survey of the influence of weave structure on the rate of shrinkage of fabrics indicates that further experiments, with more definitely graded weaves might now be undertaken. It is anticipated that this method will reveal a relationship between the values of "x" and "k" in the equation and the interlacings of the cloth. This would enable a close estimate to be made of the shrinkage power of a weave without actually constructing and processing a cloth. (C)

STAPLE FIBRE-COTTON FABRICS: PROPERTIES. C. Levi. *Bollettino Cotoniera*, 1936, V. 31, P. 486–524; abs. in *J. T. I.*, Jan. 1938, P. A42.

In a continuation of work on staple fibre-cotton mixtures sheetings were woven from 16s warp and weft yarns composed of cotton, rayon, and of cotton-staple fibre mixtures containing 12.5, 25, 37.5, 50 and 75% of staple fibre. Middling 15/16 in. cotton and staple fibre of 32 mm. and 27 mm. length were used. Details of the preparatory, spinning, weaving, bleaching, dyeing and washing processes are given and the results of tests on the yearns and tests on the fabrics before and after bleaching and before and after washing are shown in tables and graphs and are discussed. The results show that it is possible to mix more than 10% of staple fibre with cotton without causing any great differences in the properties of the fabrics. There is a gradual decrease in fabric strength with increasing content of staple fibre but in general the loss in strength, compared with the all-cotton fabric, does not reach 20% in the case of fabrics containing 25% of staple fibre and is generally not more than 25% in the case of fabrics containing 50% staple fibre. The wet strength, however, decreases more rapidly with increasing staple fibre content. (C)

TECHNOLOGICAL ADVANCES. Harry Levine. *Am. Wool & Cotton Rptr.*, Feb. 10, 1938, P. 120–2.

Review of some technical advances in new fibres, machinery, equipment and in processing. Abstract of report of Pres. Levine at recent annual meeting of the American Association of Textile Technologists in New York. (C)

TESTING RESILIENCY OF STAPLE FIBRE. Erwin J. Saxl. *Rayon Tex. Mo.*, Feb. 1938, P. 60–2, 78. (C)

TEXTILE TECHNOLOGY: RECENT TRENDS IN. Edward R. Schwarz. *Am. Dye. Rptr.*, Feb. 7, 1938, P. 78–84.

Presented at Annual Meeting, A. A. T. C. C., Philadelphia, Dec. 4, 1937. Prof. Schwarz notes that the trend of textile technology is toward a better understanding of the fundamental properties of textile materials, and toward intelligent interpretation of the results of research. (C)

TWISTLESS COTTON YARNS IN KNITTED FABRICS: USE OF. W. Davis. *J. T. I.*, Feb. 1938, P. T23–T26.

Twistless yarns are similar to those for ordinary spinning except that at the final stage, instead of giving the yarn the usual amount of twist necessary for strength, the cotton is impregnated with a suitable form of adhesive and the twist inserted in the intermediate stages of spinning is removed. The tests proved that twistless yarns are quite suitable for knitting purposes and should produce serviceable fabrics having special features and properties of handle. (1) The yarn strengths and extensions are adequate

for knitting and there are no technical difficulties. It will probably be necessary, for commercial use, to scour and bleach the twistless fabrics and the rather high extensions then produced must be borne in mind. (2) Such fabrics have an improved fullness of handle, as compared with fabrics made from twisted yarn. (3) There is a softer feel which is specially important for use in underwear. (4) There is a complete lack of spirality in the fabric which gives a better texture. There is no curling of the fabric edges when cutting. (C)

III. Chemical and Other Processing (Not Otherwise Classified)

Analysis of Dyestuff on the Fibre. J. P. Redston. *Canadian Text. J.*, Mar. 18, 1938, P. 34–6.

Discusses dyehouse practice in the identification of constituent dyestuffs on the fibre, with the object of reproducing the desired colors. (C)

Cotton: Effect of Temperature on the Retention of Water by. Charles F. Goldthwait and Earl R. McLean. *Am. Dye. Rptr.*, Feb. 7, 1938, P. 76–8.

Paper presented at Annual Meeting, A. A. T. C. C., Philadelphia, Dec. 4, 1937. (C)

Cotton: Effect of Bleaching on Affinity for Dyes. P. P. Viktorov and E. O. Wildt. *Shurn. prikl. Chimii*, 1936, V. 9 P. 1649–60; also *Chloptschatobumash. Prom.*, 1936, V. 6, No. 8/9, P. 37–43 (through *Chem. Zentr.*, 1937, ii, P. 1897); abs. in *J. T. I.*, Jan. 1938, P. A25.

The affinity of cotton for dyes rises very little after extraction of fat and wax with benzene, increases rather more on removal of nitrogenous matter by hypochlorite and reaches its maximum on removal of pectin matter by alkali. From this and dichloric effects observable under a polarizing microscope, the conclusion is drawn that bleaching is accompanied by a physical change in fibre structure. (C)

Cellulose Ethers: Why Are—Soluble in Water? J. Wakelin. *Tex. Col.*, Feb. 1938, P. 81–2. (C)

Cotton and Rayon Staple Fibre Yarns: Effect of Hydrogen Peroxide on Strength. F. Ohl. *Kunstseide*, 1937, V. 19, P. 354–58; abs. in *J. T. I.*, Jan. 1938, P. A40.

The increasing use of hydrogen peroxide in the bleaching of textile materials, the possibilities of this method for the bleaching of goods containing rayon and staple fibre, the conditions of treatment and various precautions to be taken in this method of bleaching are discussed. The results of tests of the effect on the strength of cotton, Vistra and Aceta yarns of treatment with hydrogen peroxide solutions of various concentrations for various periods at different temperatures are tabulated and discussed. The results show that no appreciable damage results from treatment of the yarns with solutions containing 10 cc. concentrated hydrogen peroxide per litre for 10 hours at 20° C, 5 hours at 50° C, or 5 hours at 100° C, or with solutions containing 25 cc. per litre for 5 hours at 20° C, 3 hours at 50° C, or 1 hour at 100° C. (C)

DYEING OF STAPLE FIBRE MIXTURES. *Rayon Tex. Mo.*, Feb. 1938, P. 67.

Describes the dyeing of mixtures of Cisalfa and wool, as well as "Lanital" and wool. Can be dyed successfully, but cautious procedure is necessary. (C)

DYEING OF SHODDY UNION PIECE GOODS. F. Jordinson. *Tex. Mfr.*, Feb. 1938, P. 74–6, 78.

Difficulties experienced in dyeing union shoddy materials, with special methods and choice of colors required. (C)

HYPOCHLORITE-BICARBONATE BLEACH: APPLICATION. L. W. Gurjanow and N. G. Klemin. *Chloptschatobumash. Prom.*, 1937, V. 5, No. 5, P. 21–3 (through *Chem. Zentr.*, 1937, ii. P. 2927); abs. in *J. T. I.*, Jan. 1938, P. A25.

It is claimed that Minajev's method of bleaching with hypochlorite and bicarbonate reduces the time of bleaching from 12 hours to 1 hour. (C)

LACQUER PRINTING ON SILK AND RAYONS. C. Frey. *Am. Dye. Rptr.*, Feb. 21, 1938, P. 103–6.

Presented at meeting, New York Section, A. A. T. C. C., Oct. 22, 1937. (C)

METALLIZED AZO DYES. M. L. Crossley. *Am. Dye. Rptr.*, Mar. 7, 1938, P. 124–9.

A paper presented at Annual Meeting, A. A. T. C. C., Philadelphia, Dec. 4, 1937. (C)

METALLIC PERCHLORATES. A. H. Pettinger. *Am. Dye. Rptr.*, Mar. 7, 1938, P. 122, 136.

Treats of their textile chemical possibilities. (C)

MOTHPROOFING SOLUTIONS. E. A. Back. *Tex. Wld.*, Feb. 1938, P. 56–7.

Results of investigation to determine protection afforded by two types: one an arsenical solution that proved to afford no protection; the other a 2% solution of penta-chloro-dioxy-triphenyl-methane-sulphonic acid solution applied in the hot dyebath, which prevented observable injury after three months exposure. (C)

PERMANENT SIZING: SOME COMMENTS ON. B. H. Little. *Am. Dye. Rptr.*, Mar. 7, 1938, P. 130–2.

Presented at meeting A. A. T. C. C., Philadelphia Section, Oct. 8, 1937, and describes ethyl cellulose as a finishing agent for cottons, and the evaluation of its resistance to the effect of laundering. (C)

RANCIDITY IN FIXED OILS USED FOR THE FINISHING OF TEXTILE FABRICS: PROBLEM OF. Kenneth L. Dorman. *Am. Dye. Rptr.*, Feb. 21, 1938, P. 89–92. (C)

REACTIVITY OF ETHYLENE AMINES. A. Tsimehe. *Silk J. & Rayon Wld.*, Feb. 20, 1938, P. 40–1.

In this article attention is drawn to the great usefulness of one of such new materials, namely, monoethylolamine as a raw material in a large number of syntheses of commercial potentiality. (C)

VELAN AND SIMILAR WATER-REPELLENT FINISHES. Chas E. Mullin. *Tex Col., Feb.* 1938, P. 96–100. (C)

WETTING, MERCERIZATION AND DYEING OF CELLULOSE: SUGGESTIVE OBSERVATIONS ON THE. Charles F. Goldthwait. *Am. Dye. Rptr.*, Feb. 7, 1938, P. 70–6.

The author states that "this paper as a whole presents incidental observations made during extensive studies on processing cotton. These observations are believed to be of some general interest, and may in some instances be suggestive for mill processing. However, they are offered mainly because they seem to represent clues which suggest additional research which may, in turn, help explain important cellulose phenomena." Paper presented at Annual Meeting, A. A. T. C. C., Philadelphia, Dec. 4, 1937. (C)

WOOL DYEING: SIGNIFICANCE OF TEMPERATURE IN. F. L. Goodall. *J. Soc. Dyers Col.*, Feb. 1938, P. 45–65.

Experimental evidence has been brought forward to show that the sorption of dyes by wool is much affected by particle size of the dyes concerned in relation to swelling of the fibre under any particular conditions. Whereas with a sufficiently long dyeing time a molecularly dispersed dye like Acid Orange GG can reach the same final equilibrium distribution of dye between fibre and dyebath, and give the same dyed shade at all temperatures, a colloidal dye, by virtue of greater particle size, cannot be taken up at low temperatures either to the same extent or in the same manner as at 100° C. Whilst the main object of raising the temperature of an Acid Orange GG dyebath is, therefore, to reach exhaustion in an economically reasonable period of time, the object of increasing the temperature of a colloidal dyebath, such as of Polar Yellow R Conc., is to provide conditions under which, firstly, the fibre can take up an appreciable amount of dye and, secondly, the dye sorbed can be finely dispersed within the fibre. In the case of Polar Yellow R Conc., dyeings of medium depth, from the usual acetic acid and Glauber's salt bath, show a critical sorption temperature at about 60° C., below which it is impossible for all the dye in the dyebath to enter the fibre, and a critical dispersion temperature at about 80° C., below which the sorption although similar in amount to that shown at 100° C., is of a much coarser type. The critical sorption and dispersion temperatures vary with the amount and nature of the dyebath additions. In normal practical dyeings of Polar Yellow R Conc., entered at about 40° C., the sorption occurs in two phases, *i.e.*, above and below the critical sorption temperature, and the actual dyeing process consists of three phases (a) below the critical sorption temperature, (b) between the critical sorption temperature and the critical dispersion temperature, and (c) above the critical dispersion temperature. Sorption and dye-in-fibre dispersion of a coarse type occur in (a) and (b) and must subsequently be corrected in (c) into the finer type of sorption and dispersion shown by dyeings completed at the boil. The coarse type of sorption occurring in (a) and (b) is shown to lead to unsatisfactory practical results as regards levelness, penetration, fastness to rubbing, brightness, and fullness of shade, and an alternative dyeing method is proposed on the basis of the effects of temperature, Glauber's salt, and acid on the fibre swelling and dye dispersion, whereby the whole of the dyeing process is carried out in phase (c). The method consists of entering at the boil

into dyebaths free from Glauber's salt and containing approximately the normal amounts of acid, partially or entirely neutralized by ammonia. Bulk and laboratory trials are reported to show that the method gives much improved results as regards levelness, penetration, fastness to rubbing, and brightness of shade, with at least equal fastness and strength properties of the dyed materials. (C)

IV. Research Methods and Apparatus

Identification of Vat Dyes on the Fibre. G. B. Ferraris. *Rev. Gen. Tein. Imp. Blanch. App.* 1937, V. 15, P. 411–9; 539–47; 603–9; 669–77; abs. in *J. Soc. Dyers Col.*, Feb. 1938, P. 87.

Tests for the identification of individual dyes described by Herzog in Reactionstabelle der Küpenfarbstoffe (*Tiba*, 1933, *49*, 326) are now supplemented by tests with nitric acid and stannous chloride. These new tests are carried out by placing a sample of the dyed material on a sheet of filter paper, folded in four, and spotting it with a glass rod moistened with concentrated nitric acid (*d* 1.40–1.45), or a solution of 10 g. stannous chloride in 100 cc. 10% hydrochloric acid. The color changes which occur on spotting are noted, as well as whether the filter paper is stained more or less when the spotted part is pressed strongly within it. The color reactions of 101 vat dyes in these two tests, with sulphuric acid, and with both alkaline and acid Hydrosulphite are tabulated, as well as their solubilities in benzene and pyridine. The tables indicate the value of these two new tests in the identification of those vat dyes which give very similar color reactions with sulphuric acid and Hydrosulphite. (C)

Injury to Wool by Staining: Proofs of—and Their Validity. R. Folgner and G. Schneider. *Mell. Textilber.*, 1938, No. 3, P. 273.

It is impossible to determine, by means of any staining method, the extent to which wool has been injured during the course of manufacture, even when the untreated material before manufacture is at disposal. Serious injury can soon be determined, but probably no method of staining will suffice to show it plainly in its initial stages. When wool that has been injured by the action of acid is examined by the staining methods, it will not by any means show the same rise in staining properties as wool that has been injured by alkaline action. On the other hand, when the injury is determined with the aid of the soluble nitrogen of the wool, it will be found that wool that has been injured by alkaline action shows a slighter rise of the values, but the differences in the acid numbers of wool that has been injured by alkali as distinguished from wool that has been injured by acid, in relation to the same loss of strength, are not by any means of the order indicated by the application of staining methods. In order to be able to prove injury satisfactorily, the attempt must first be made to ascertain qualitatively whether the injury is due to alkali or to acid, perhaps with the aid of the Allwörden reaction and the swelling reaction according to *Krais*, *Markert*, and *Viertel*. That process must be followed by determination of the soluble nitrogen according to Sauer's method as modified by *Folgner* and *Schneider*, in order to be able to express the injury in figures. An idea of the extent of the injury may also be gained by staining with indigo carmine and determining the number of the stained and of the uncolored hairs among one hundred test hairs, but that method premises the exact determination of the details of the condi-

tions under which it is to be carried out, such as hydrogen ion concentration, time, temperature, and concentration of the dyebath. (C)

MEASURING THE CURL OF STAPLE FIBRE. H. J. Henning. *Mell. Textilber.*, 1938, No. 3, P. 229.

This article is a discussion of the properties that determine the extent of curl of staple fibre, such as the form of the curl, the number of bends in the curl, the size, strength, and the reversibility of curl. A simple apparatus for measuring the extent of curl, its strength, and its permanence is described which makes use of an ordinary torsion balance as weighting instrument. The measurements carried out with this apparatus are based upon the principle of the ordinary elasticity tests on individual fibres. The size of the curl was determined for a number of raw staple fibres and compared with the fibre curl of finished tops. In order to evaluate the graphs plotted for decurling and relieving the tension on several types of fibres, it was proposed to use the method of determining the work expended on decurling and the loss of work involved in allowing the fibres to pass through a cycle of loading and relieving the load. The article concludes with hints on the examination of the influence of time and humidity, extending the range of loading. (C)

PHOTOMICROGRAPHY OF TEXTILE PRODUCTS. PART I, II. Alois Herzog. *Mell. Textilber.*, 1938, No. 3, P. 227; No. 4, P. 317. (C)

PHYSICAL AND CHEMICAL TEXTILE TESTING. VI. John H. Skinkle. *Am. Rptr.*, Feb. 21, 1938, P. 109–15.

This is a continuation of the physical testing section of this valuable series of articles, and covers testing of fabrics for thermal properties, handle or draping quality, serviceability, wear and abrasion. (C)

PHYSICAL TESTING OF TEXTILE MATERIALS: STANDARD SPECIFICATIONS AND METHODS OF. R. H. Adams. *Am. Dye. Rptr.*, Feb. 21, 1938, P. 97–9.

Presented before meeting, Southeastern Section, A. A. T. C. C., Oct. 9, 1937. (C)

RAYON AND CELLULOSE ACETATE SILK, TREATMENT OF: METHODS OF DELUSTERING. Ray Mitcheson. *Dyer*, V. LXXVIII, No. 9; abs. in *Rayon Tex. Mo.*, P. 103.

A discussion of methods of delustering in general. A description of the use of polarized light in measurement is given, also explains the use of the Goerz and the Askania lustremeters. Gives direction for detection of delustrants such as titanium, barium sulphate and various organic materials. Finishes with a list of six properties on which the lustre of a normal rayon depends. (C)

STIFFNESS AND RESILIENCY: QUANTITATIVE MEASUREMENT OF. Erwin J. Saxl. *Am. Dye. Rptr.*, Feb. 7, 1938, P. 65–9.

Paper delivered before the A. A. T. C. C. annual meeting, Philadelphia, Dec. 4, 1937. Describes methods that permit the quantitative evaluation of stiffness of fabrics and yarns, and an instrument developed for this purpose. (C)

V. Economics, Physics and Miscellany

Anisotropy of van der Waal's Forces. J. H. de Boer. *Physica*, Nov. 1937, P. 1045–55 (in German).

The orientation of molecules subjected to van der Waals forces of attraction results from two opposing effects (1) the resultant of the van der Waals forces which seek to so direct the molecules that each atom has as many neighbors as possible, and (2) the anisotropy due to polarizability which tends to make the axes of strongest polarizability lie in the line of molecular bondage. In general (1) predominates, so that long molecules lie parallel to one another, ring shaped molecules are superimposed and so on. For diatomic molecules, however, there can be preponderance of (2), in which case the two molecules would line in the direction of their common axes. The influence of a boundary wall is also considered. As an appendix G. Heller (pp. 1055–7) applied London's theory for the van der Waals forces to anisotropic molecules. (X)

Anomaly in Elastic Behavior of India Rubber. A. N. Puri. *Nat. Acad. Sci., India Proc.*, 1937, V. 7, No. 1, P. 45–51.

The Young's modulus and rigidity for a sample of india rubber are determined. Young's modulus is measured both statically and dynamically. It is found that the dynamical value is about twice the statical value for all loads. The cause of this anomaly is observed but no satisfactory explanation has been found. (X)

Bromine on Proteins: Effect of. F. Lieben and R. Tandler. *Biochem. Z.*, 1937, V. 292, P. 82–91 (through *C. A.*, 1937, V. 31, Col. 7903).

The hypothesis is developed that on brominating proteins the Bromine is attached near the peptide linkage. All evidence seems to be against the assumption of the attachment of the bromine to the cyclic amino acids. The histidine is so altered by bromination that on hydrolysis it appears in the phosphotungstic acid filtrate. However, it is still not clear why the bromine is more firmly attached to casein than to either gelatin or collagen. (C)

Cellulose and Cellulose Hydrate: Fibre Diagrams. E. Sauter. *Z. physikal. Chem.*, 1937, B. 37, P. 161–7; abs. in *J. T. I.*, Jan. 1938, P. A52.

By means of a rotating X-ray goniometer a new fibre diagram can be obtained, in which the diatropic reflections of the basic surfaces of the fibre appear by themselves and completely on the corresponding S-shaped lattice lines of the diagram. This method is used to determine the intensity ratios of the diatropic reflections of native cellulose and cellulose hydrate. The results support the views of Sponsler and Dore and not the lattice model of Meyer and Mark. (C)

Cellulose Esters and Ethers: Solubility. W. Coltof. *J. Soc. Chem. Ind.*, 1937, V. 56, P. 363–75T; abs. in *J. T. I.*, Jan. 1938, P. A53.

A theory of the swelling, and dispersion, that is dissolution, of highly polymerized substances, is developed. The results of the study are tabulated and discussed in detail. (C)

DRYING: HOW MUCH DO WE KNOW ABOUT IT? F. C. Stamm. *Paper Trade J.*, Feb. 24, 1938, P. 103–7.

Although the discussion is confined to problems connected with pulp and paper drying, many of the problems are also common to textile drying. Of particular interest is the effect of air upon heat transfer. The author stated that "we still know very little about heat transfer," and urges further research on this and other problems and basic principles of drying. (C)

MOISTURE CONTENT OF PAPER BOARD: INFLUENCE OF ATMOSPHERIC HUMIDITY AND TEMPERATURE ON THE. R. W. K. Ulm. *Paper Trade J.*, Feb. 24, 1938, P. 108–16.

An hysteresis exists in the moisture contents of paper boards at equilibrium with atmospheres of given relative humidities at all temperatures in the ordinary range. The direction of approach to the equilibrium condition, *i.e.*, whether by adsorption or by desorption, determines more than any other factor the moisture content at a given relative humidity.

The effect of temperatures on the moisture content of board in equilibrium with an atmosphere of a given relative humidity is noticeable at all humidities studied. In the higher range of relative humidities, the effect is relatively small, the moisture content passing through a minimum in the neighborhood of 70° F. In the lower range of relative humidities the effect of temperature is larger, the lower the relative humidity. At the low humidity, the moisture content decreases linearly with increasing temperature.

At a constant absolute humidity the moisture content at equilibrium decreases with increasing temperature. It is apparent, therefore, that, excluding the phenomenon of hysteresis, the moisture content of a piece of board is determined by fixing any two of the three variables, temperature, absolute humidity, and relative humidity. The specification of only one of these variables is insufficient to determine the moisture content. It is also impossible to fix arbitrarily all three, since only two can be independent; specification of two determines the third. (C)

RUBBER LATEX FILMS FOR TEXTILE APPLICATIONS: EVALUATION OF. B. A. Harold. *Tex. Col.*, Feb. 1938, P. 92–5, 132. (C)

TEXTILE EDUCATION. Frederick M. Feiker. *Tex. Wld. Annual*, Feb. 28, 1938, P. 84–5.

The author, who has acted as textile education consultant for the Textile Foundation, describes the latter's program in co-operation with the deans of textile schools and of the textile departments of colleges, for the more adequate training of men for the textile industry. (C)

SOLID FRICTION. J. Mercier and J. Dubois. *Comptes Rendus*, Nov. 22, 1937, P. 964–6.

As a result of preliminary studies of kinetic friction (K) it is concluded that the K/pressure (p) and K/velocity (v) curves are more regular as p and v are higher. As v increases from zero K diminishes to a minimum for v = a few tenths of 1 mm./sec., and then usually increases to a maximum. Hardness has a great effect, the average value of K decreasing as hardness increases. Similarly polishing reduces K and increases the regularity of the curves. (X)

Book Reviews

AN INTRODUCTION TO THE STUDY OF SPINNING. W. E. Morton. Longmans, Green & Co., Ltd., London and New York City. (1937). Pp. 267, illustrated. Price, $4.50.

The average manufacturer and technician, engaged, for instance, in cotton spinning and its preparatory processes, usually is ignorant of the methods and problems of preparing and spinning woolen, worsted, silk, linen and jute yarns. This statement is equally true of those engaged upon any one of the other fibres. Their mill and school training usually is concentrated upon the existing methods and problems of a single branch of the textile industry, yet it is a fact that all branches of this great industry have much in common, not only in their ancestry, but in their basic and practical problems; it is also true that those engaged upon any one fibre have much of value to learn by a study of methods employed in the spinning of the other textile fibres. Fortunately, the advent of synthetic fibres which are capable of being processed upon any type of textile machinery (although not in all cases efficiently) is awakening technicians to the advantage of a more general knowledge of methods employed in other branches of the industry than the one in which they have specialized. Professor Morton's book serves admirably as an introduction to the attainment of that knowledge. He explains that his "aim has been to direct the student's attention in the very beginning to the fundamental nature of the processes through which the raw materials have to go in the course of yarn manufacture; to show how the evolution of the various modern machines from the original handicraft appliances has been influenced in each case by the character of the raw material it was intended to treat; and to exclude as far as possible all references to confusing mechanical complications until there is no longer any risk of their crowding out of the picture the things that really matter. In short, he has endeavored to prepare the ground for later specialization in such a way that the student can proceed to the more advanced stages of his work in a restricted field with a proper sense of proportion and in a more inquiring frame of mind." The author is professor of textile technology in the University of Manchester, Eng., and head of the textile department, Manchester College of Technology. (C)

MANAGEMENT OF A TEXTILE BUSINESS. C. C. Balderston and V. S. Karabasz. The Textile Foundation, Commerce Bldg., Washington, D. C. (1938). Pp. 210, price $2.00; in combination with three other books of the Textile Economics Series, $6.00.

This is one of the four books of the Textile Economics Series, prepared by members of the staff of the Wharton School of Finance and Commerce, University of Pennsylvania, the cost of preparation having been underwritten by The Textile Foundation, and allowing sale at cost of publication.

"Management of a Textile Business" focuses attention upon management policies and techniques that must be considered in the running of a mill. It is concerned with the layout of the mill and its equipment; the control of labor and labor costs; the procurement and storage of materials and supplies; controlling the flow of orders through the mill; price setting; and the control of the business as a whole through organization, supervision and budgeting. The illustrative material is drawn from actual situations that clarify the discussion and bring out significant comparisons between the various textile industries. (C)

TEXTILE COSTING—AN AID TO MANAGEMENT. Jeremiah Lockwood and Arthur D. Maxwell. The Textile Foundation, Commerce Building, Washington, D. C. (1938). Pp. 282, price $2.00; in combination with three other books of the Textile Economics Series, $6.00.

This is one of the Textile Economics Series, prepared by the staff of the Wharton School of Finance and Commerce, University of Pennsylvania, under grant of The Textile Foundation.

It stresses the importance of cost data and their use to management in the running of a mill. It is not intended for textile accountants, but rather to indicate to executives the principles of costing and the ways in which a knowledge of costs can help management in making its control of mill operations more effective. The burdensome detail of journal entries, cost forms and accounting department records, characteristic of most texts on accounting, has been reduced to a minimum and has not been permitted to overshadow the basic principles of material, labor and overhead costs and their implications to management. (C)

THE TEXTILE INDUSTRIES—AN ECONOMIC ANALYSIS. H. E. Michl. The Textile Foundation, Commerce Building, Washington, D. C. (1938). Pp. 284, price, $2.00; in combination with three other books of the Textile Economics Series, $6.00.

This is one of the Textile Economics Series, prepared by the staff of the Wharton School of Finance and Commerce, University of Pennsylvania, under a grant of The Textile Foundation.

It focuses attention upon the industry as a whole, although giving major attention to the cotton branch "because of its great importance," and because "many of the problems of the cotton industry are common to the wool, silk and rayon industries." It shows how the policies of the individual mill are influenced by those of its competitors and how the industry as a whole is affected by economic forces such as fluctuating raw material prices, excess capacity, rise of new producing areas, international competition, changes in rates of growth, etc. Each branch of the industry is given separate treatment and its particular economic problems are analyzed. The book ends with a discussion of proposed methods of stabilizing the textile industries through individual action and by trade association activities and governmental regulation. (C)

THE MARKETING OF TEXTILES. Reavis Cox. The Textile Foundation, Commerce Building, Washington, D. C. (1938). Price $2.00; in combination with three other books of the Textile Economics Series, $6.00.

Another of the Textile Economics Series, prepared by the staff of the Wharton School of Finance and Commerce, University of Pennsylvania, under grant of The Textile Foundation.

It describes the methods used by the textile industries to move its products into consumption. Beginning with a discussion of the marketing of raw cotton, wool, silk and rayon, it traces the methods and agencies employed in marketing yarn and cloth from process to process into the hands of industrial and institutional buyers, cutters and ultimate consumers. It also discusses the influence of styles and fashions and the methods employed to cope with them; the price policies and problems of the industry and their influence on marketing; and concludes with a discussion of devices for sales promotion, the problem and control of unfair competition, and proposed ways of reducing the costs of marketing. (C)

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